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Device for Filling Containers

The invention relates to a device for filling containers, comprising an arrangement for feeding filling material to at least one dosing system which forms a flow path in which there is a dosing valve which can be opened at least for the duration of the dosing processes in order to deliver the dosing amounts of the filling material to the pertinent containers by way of at least one filling line.

In the pertinent prior art, a system which economically enables automated molding (blow molding or vacuum molding), filling, and sealing of containers is known under the trademark bottelpack®. When the indicated containers are to be filled with sensitive products, for example, pharmaceuticals, on the one hand the international standards for aseptic packaging must be satisfied, and on the other hand it must be ensured that during each filling process a specific dosing amount is filled in, and the quantity of the filling amount must be maintained with the greatest precision, especially when highly efficacious pharmaceuticals are involved.

To meet these requirements, in a device of the initially named type which is disclosed in document EP 0 418 080 B1, for each filling line which is assigned to a pertinent container to be filled, there is a dosing valve which opens and closes in a time-controlled manner by means of

electromagnetic actuation, the opening time for each dosing process being chosen such that at a set buffer pressure of the filling material which is available in a dosing distributor, the desired dosing amount flows through the dosing valve during the opening time.

Based on this prior art, the object of the invention is to make available a device of the aforementioned type which is characterized by increased dosing accuracy compared to the prior art.

This object is achieved according to the invention by a device which has the features of claim 1 in its entirety.

Accordingly, one essential feature of the invention consists in that downstream of the dosing valve there is a controllable means by which a suction action can be produced on the flow path when the respective dosing processes are completed, specifically when the pertinent dosing valve closes. When the dosing process is ended, in the filling line this yields a suction action which causes return suction of the remaining liquid out of the filling line or at least prevents dripping of liquid afterwards. A maximum of dosing accuracy certainly can be achieved in this way.

In advantageous exemplary embodiments, between the dosing valve and the filling line there is a choke site, which constricts the flow path during the dosing processes, in the region of the choke site there being a movable control element which defines the width of the flow path depending on its position setting and which can be transferred into a position which widens the flow path at the choke site by forming a bypass when the means which produces the suction action is activated. The choke site, which in interaction with the time control of the opening time of the dosing valve determines the dosing amount, in interaction with the control element which defines the width of the flow path also forms a part of the means which produces the suction action and whose operating principle consists in that the movable control element forms a widening in the flow

path as a bypass of the choke site, resulting in an enlargement of the inside volume of the flow path and thus an afterflow effect.

The arrangement in this connection can be advantageously made such that the means which produces the suction action is formed by a bypass valve designed as a diaphragm valve whose diaphragm which forms the movable control element with its one closing side delimits the flow path at the choke site and on whose other control side a negative pressure can be applied for producing a suction action in order to cause the diaphragm to execute a deflection motion which widens the flow path and whose lift produces the suction action on the filling line. In these exemplary embodiments the means which produces the suction action is characterized by an especially simple construction.

The dosing valve can also be formed by a diaphragm valve in a correspondingly advantageous manner.

An especially compact and simple structure of the dosing system can be achieved when the dosing valve and downstream bypass valve are diaphragm valves which are controlled by a joint diaphragm extending along the flow path.

In order to support the movement of the diaphragm both at the dosing valve and at the bypass valve into the rest position, i.e., into the respective closed position, and to elicit deflection movements out of the rest position, on the control side of the diaphragm opposite the closing side alternately an overpressure as the closing pressure and an underpressure as the opening pressure can be applied to the pertinent dosing valve and to the pertinent bypass valve by way of assigned control lines.

Advantageously, the arrangement can be made such that for a plurality of filling lines respectively assigned dosing units are combined in a dosing block, the input sides of the respective

dosing valves being connected to a common distributor of the filling material which is under a set buffer pressure.

In such a design, in the dosing block there can be a diaphragm which is assigned to the dosing valves and bypass valves and which is common to the dosing system as a whole.

In operation with this dosing block, the diaphragm can be triggered jointly on the bypass valves from a common control line, while for the control sides of the diaphragm on the dosing valves, each filling line has its own control line for pressure and negative pressure.

The invention is detailed below using one exemplary embodiment shown in the drawings.

- FIG. 1 shows a side view of only the dosing block with the pertinent distributor of filling material of one exemplary embodiment of the device according to the invention, which view is approximately half-size compared to a practical embodiment;
- FIG. 2 shows a section which has been enlarged compared to FIG. 1 according to the cutting line II – II from FIG. 1;
- FIG. 3 shows a schematically simplified vertical section of a device for producing and filling containers, one filling line being shown which is connected to the pertinent filling line output of the dosing block shown in FIGS. 1 and 2; and
- FIGS. 4a to 4d show schematic sketches in illustration of the construction and manner of operation of the dosing valve means according to the exemplary embodiment of the invention.

The invention is explained below using one example in which the device contains a plurality of dosing systems, specifically according to FIG. 1, fifteen dosing systems 5 which are combined in a common dosing block 1. From a common distributor of filling material 3 in which the liquid to be filled in is under a set buffer pressure, each of the dosing systems 5 within the dosing block 1 receives the liquid filling material via a feed line 7, of which only a few are numbered in FIG. 1. In the course of operation, the dosing systems 5 deliver the dosing amounts to a corresponding filling line 9 (likewise not all numbered in FIG. 1). Each filling line 9 leads to a device, which is not shown in FIG. 1, for producing and filling containers, for example, a device according to the known bottelpack[®] system.

Of this device, only FIG. 3 schematically shows a production and filling unit. As is apparent from this figure, each of these systems has a filling mandrel 11 on whose end, which is at the top in the figure, there is a supply head 13 for supply of channels in the filling mandrel 11 with media. As FIG. 3 shows, on the supply head 13 the pertinent filling line 9 is connected to a filling material channel 15 which runs centrally in the filling mandrel 11. The filling material which has been supplied, dosed by way of the respective filling lines 9, emerges on the lower, fill needle-like end 17 of the filling mandrel 11 for filling of a respective container 19, which is formed in a forming device 21 according to the aforementioned bottelpack[®] system from plastic tubing 23 which is produced by means of an extruder head 25 from plasticized plastic material.

FIGS. 2 and 4 show details of the dosing units 5 combined in the dosing block 1. As is apparent, on a flow path 27 which runs between the feed line 7 and filling line 9 two valves are connected in succession, specifically an upstream dosing valve 29 and a bypass valve 31 conversely located downstream. Both valves are diaphragm valves with a diaphragm 33 which is pneumatically controlled for deflection and resetting movements. The diaphragm 33, which is preferably made from a plastic material such as PTFE or a rubber material, is common to both valves 29 and 31 of a dosing system 5, and also common to all dosing systems 5 contained in the dosing block 1; i.e., the

diaphragm 33 extends over the longitudinal area of the dosing block 1. Each dosing valve 29 has its own pneumatic connection 35 for individual application of pressure or negative pressure to the control side 37 on the respective dosing valve 29. In FIG. 1 not all of the pneumatic connections 35 are numbered. The bypass valves 31 all have a pneumatic connection 39, which is common to them in order to apply a pressure or a negative pressure to the control side 37 of the diaphragm 33 on the respective bypass valve 21.

FIGS. 4a to 4d best illustrate how the dosing systems 5 work. As shown, on the dosing valve 29 and bypass valve 31 on the control side 37 of the diaphragm 33 there is a spherical cap-shaped space 43 into which a surface region of the diaphragm 33 can be deflected when negative pressure is applied to the control side 37 by way of the pneumatic connections 35 or 39, by which the opposite closing side 45 of the diaphragm 33 is raised out of the closed position and deflected into the respective space 43; this causes opening of the pertinent valve 29 or 31. FIG. 4a shows the dosing valve 29 in the closed position, while the bypass valve 31 is opened. FIG. 4b shows the dosing valve 29 open, while the bypass valve 31 is closed. FIG. 4c shows both valves 29 and 31 in the closed position, while FIG. 4d in turn shows the dosing valve 29 closed and the bypass valve 31 open. On the bypass valve 31 there is a respective choke site 41 on the flow path 27. FIG. 4a shows the rest position of the system prior to the respective dosing process, the dosing valve 29 still being closed while the bypass valve 31 is in the open position. In this open position of the bypass valve 31 in which the diaphragm 33 is deflected into the spherical cap-shaped space 43, the flow path 27 is significantly widened compared to the state with the bypass valve 31 closed according to the volume of the respective chamber 43. With the bypass valve 31 open, passage not only via the choke site 41 is thus available to the flow path. FIG. 4b illustrates the dosing process in which the dosing valve 29 is opened, while the bypass valve 31 is closed so that the size of the passage of the choke site 41 in conjunction with the time-controlled length of opening of the dosing valve 29 determines the dosing amount.

FIGS. 4c and 4d illustrate the completion of the dosing process by closing of the dosing valve 29 (FIG. 4c). After completed closing of the dosing valve 29, the bypass valve 31 is opened as shown in FIG. 4d. The corresponding deflection motion of the diaphragm 33 into the spherical cap-shaped space 43 leads to a considerable widening of the flow path 27 at the bypass valve 31. This lifting motion of the diaphragm 33 with the dosing valve 29 closed produces a suction action which causes return suction of liquid from the downstream filling line 9.

As already mentioned, the dosing amount is determined by time control of the duration of opening of the respective dosing valve 29 via the individual pneumatic connection 35. The suction action on the filling lines 9 can be produced simultaneously for all dosing systems 5 by the pneumatic connection 39 which is common to them being triggered.

It should be noted that for conventional cleaning and sterilization measures as are carried out conventionally before the start of the production phases, the dosing valves 29 and the bypass valves 31 are controlled into the open position. Thus, the unchoked flow path 27 is available for throughflow of cleaning and sterilization media, that is to say, originating from the distributor of filling material 3 via the feed line 7, dosing system 5, and filling line 9 to the filling material channel 15 of the pertinent filling mandrel 11.

C l a i m s

1. A device for filling containers, comprising an arrangement (7) for feeding filling material to at least one dosing system (5) which forms a flow path (27) in which there is a dosing valve (29) which can be opened at least for the duration of the dosing process in order to deliver the dosing amounts of the filling material to the pertinent containers (19) by way of at least one filling line (9), **characterized in that** the dosing system (5) in the flow path (27) downstream of the dosing valve (29) has a means (31, 33, 43) for optionally producing a suction action on the flow path (27) and that there is a control mechanism (39) which activates the means (31, 33, 43) which produces the suction action depending on the dosing processes which have been ended by closing of the dosing valve (29).
2. The device according to claim 1, characterized in that between the dosing valve (29) and the filling line (9) there is a choke site (41) which constricts the flow path (27) during the dosing processes and that in the region of the choke site (41) there is a movable control element (33) which defines the width of the flow path (27) depending on its position setting and which can be transferred into a position which widens the flow path (27) at the choke site (41) by forming a bypass when the means (31, 33, 43) which produces the suction action is activated.
3. The device according to claim 2, characterized in that the means which produces the suction action has a bypass valve (31) designed as a diaphragm valve whose diaphragm (33) which forms the movable control element with its one closing side (45) delimits the flow path (27) at the choke site (41) and to whose other control side (37) a negative pressure can be applied for producing a suction action in order to cause the diaphragm (33) to execute a deflection motion which widens the flow path (27) and whose lift produces the suction action on the filling line (9).

4. The device according to claim 3, characterized in that the dosing valve (29) is formed by a diaphragm valve.
5. The device according to claim 4, characterized in that the dosing valve (29) and downstream bypass valve (31) are diaphragm valves which are controlled by a diaphragm (33) extending along the flow path (27) and which is common to them.
6. The device according to claim 5, characterized in that on the control side (37) of the diaphragm (33) opposite the closing side (45) alternately an overpressure as the closing pressure and an underpressure as the opening pressure can be applied to the pertinent dosing valve (29) and to the bypass valve (31) via assigned control lines (35, 39).
7. The device according to one of claims 1 to 6, characterized in that for a plurality of filling lines (9) respectively assigned dosing systems (5) are combined in a dosing block (1), the input sides of the respective dosing valves (29) being connected to a common distributor (3) of the filling material which is under a set buffer pressure.
8. The device according to claim 7, characterized in that in the dosing block (1) there is a diaphragm (33) which is assigned to the dosing valves (29) and bypass valves (31) and which is common to all dosing systems (5).
9. The device according to claim 8, characterized in that for the control side (37) of the diaphragm (33) on the dosing valves (29) for each filling line (9) each has its own control lines (35) for pressure and negative pressure.
10. The device according to claim 9, characterized in that a common line (39) via which a negative pressure can be applied for simultaneous activation of the respective means which

produces the suction action is assigned as a control mechanism to the control side (37) of the diaphragm (33) on the bypass valves (31).